Al-Mustaqbal University

Collage of Engineering

Prosthetics and Orthotics Engineering

Second Stage

PRINCIPLES OF PROSTHETICS AND ORTHOTICS

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UOMU0103031

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Technique of Amputation

Preparation

- All elective amputation patients should be properly prepared and undergo local preparation of the surgical site.

Anesthesia

- Local, regional, spinal, or general anesthesia may be given.
- The choice depends on the patient's general condition, the anesthetist's expertise, and the patient's preference.

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Technique of Amputation

Tourniquet

- No tourniquet should be applied in patients with peripheral vascular disease.
- In all other cases, whenever possible, a pneumatic tourniquet can be used.

Stump Flaps

- Flaps should be mapped out prior to surgery.
- It is better to start with long flaps; excess can be trimmed later if necessary.
- In vascular diseases, a long posterior flap is preferred to promote better wound healing.

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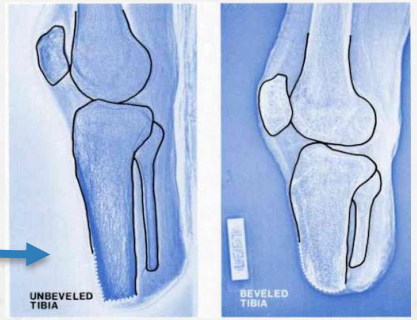
Technique of Amputation

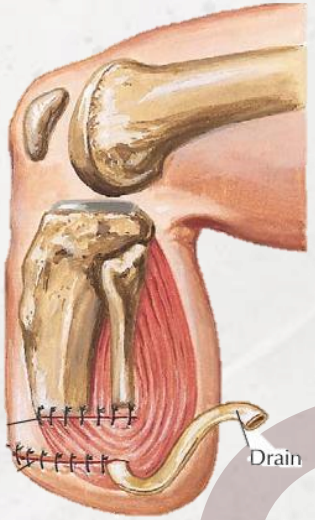
Bone

- Bone level is marked prior to surgery.
- In transtibial amputation, the fibula is cut 1–3 cm above the tibia.
- The tibia is beveled at 45–60 degrees.
- All cut edges are filed and shaped to form a smooth, rounded end.



Blood Vessels

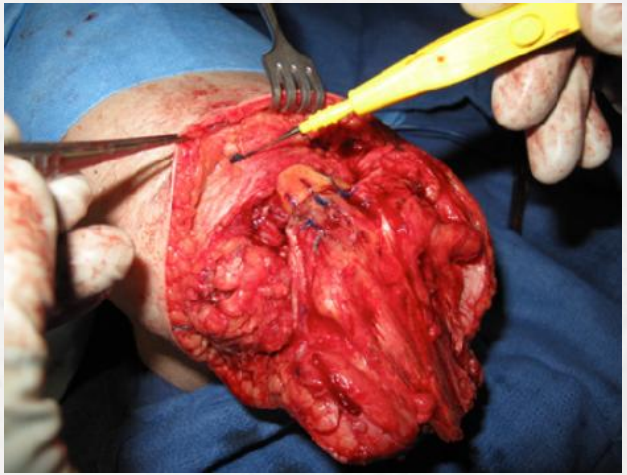
- Blood vessels are isolated, ligated, and cut to achieve hemostasis.
- A drain is placed, preferably with vacuum suction.



4 Technique of Amputation

Muscles

Muscles carry blood supply from deep tissues to the fascia and skin, so they should not be dissected away from the deep fascia or skin.



Muscles provide:

Padding at the lower end

Stump control when fixed

Proprioceptive feedback

Surgical techniques used:

Myoplasty: Attachment of opposite compartment muscles to each other and to the periosteum at the cut end of the bone.

Myodesis: Direct suturing of muscles and fascia to the bone through drill holes.

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Technique of Amputation

Nerves

Proper handling of peripheral nerves is essential to prevent complications such as stump neuroma.

- Nerves are gently pulled, cut as high as possible, and allowed to retract into deeper tissues.
- The nerve end may be injected with neurolytic agents (e.g., phenol).
- The nerve end may be buried in bone.
- The nerve end may be enclosed with materials such as silicone.

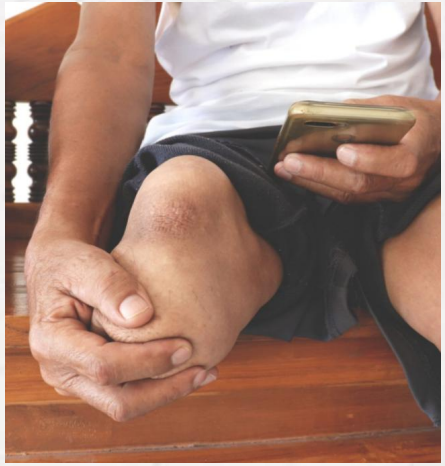
Wound Closure

The wound is closed in layers with physiological tension (neither too tight nor too loose).

Skin Closure

The skin is closed using interrupted sutures rather than continuous sutures.

Technique of Amputation



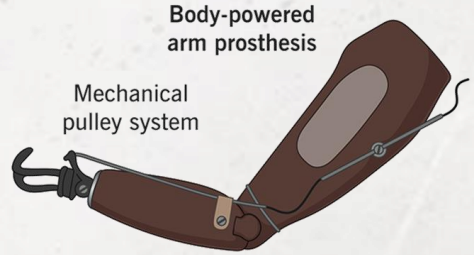
Stump (Residual Limb)

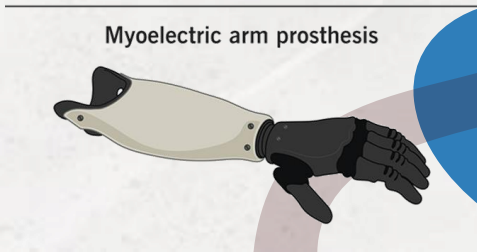
The residual part of the limb left after amputation is called the stump.

The term “ideal stump” is no longer commonly used because a prosthesis can be fitted to any stump length.

Additionally, a stump length may be ideal for one type of prosthesis but not for another.

Example: For a below-elbow prosthesis, a length of 8 inches is ideal for a body-powered mechanical hand but may be too long for an electrically powered myoelectric hand.



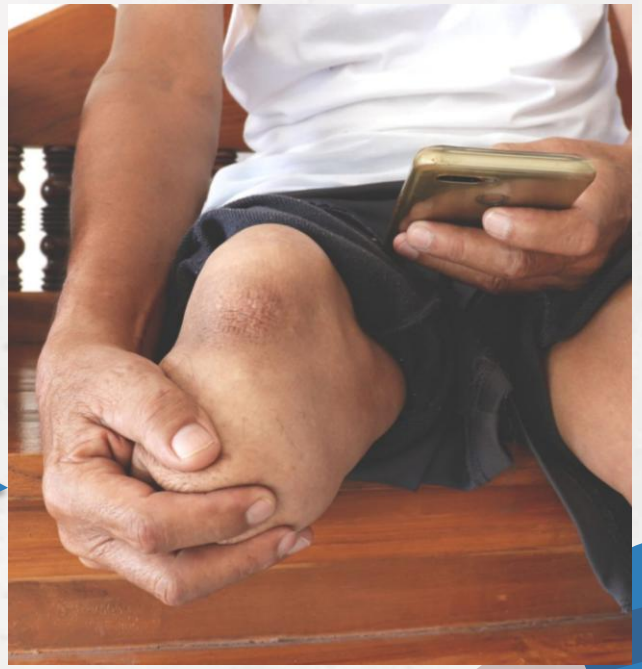


Technique of Amputation

Stump (Residual Limb)

Features of a good stump:

1. Proper length (size)
2. Proper shape
3. Skin is healthy and free of issues
4. Scar is healthy and free
5. Muscles have good strength
6. Joint has full range of movement (no deformity)
7. No neuroma
8. No phantom sensation or pain



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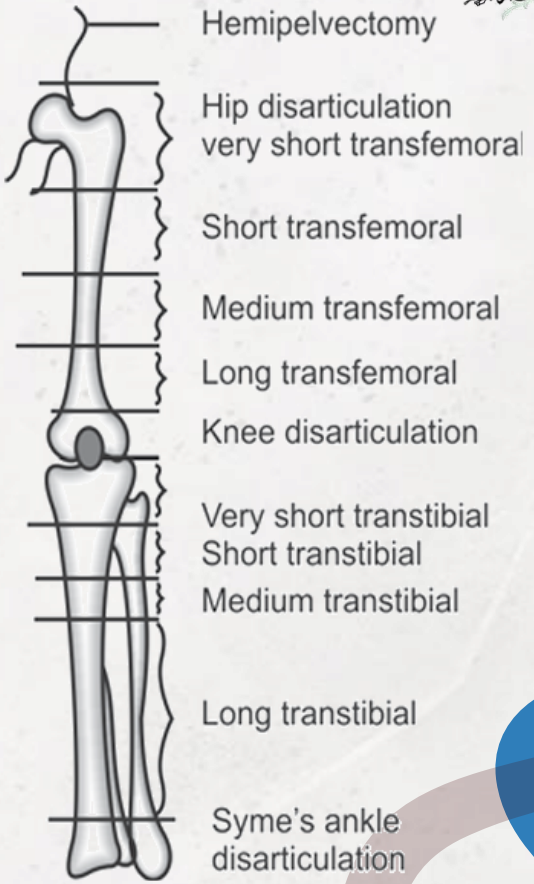
Selection of Surgical Level

The choice of amputation level is critical and depends mostly on the underlying pathology:

Malignancy: If local resection and chemotherapy are not feasible → amputation above proximal joint.

Vascular disease: Level usually determined intraoperatively based on tissue viability and skin bleeding.

Principle: Preserve as much limb as possible while ensuring healthy tissue for healing and prosthetic fitting.



Selection of Surgical Level

Lower Limb Amputations

Naming: Based on bones (transfemoral, transtibial) and residual stump length (very short, short, medium, long).

Transtibial Amputation (Below Knee)

Ideal	5 inches from tibial tubercle
Minimum	2 inches from tibial tubercle

Classification by stump length:

Long: Junction of lower & middle 1/3 of tibia

Standard: Junction of upper & middle 1/3 of tibia

Short: Upper 1/3 of tibia

Ultrashort: Just below tibial tubercle

Healing improves inversely with stump length.

Selection of Surgical Level

Transfemoral Amputation (Above Knee)

Ideal	10 inches from greater trochanter
Minimum	5 inches from greater trochanter
Maximum	4 inches from knee joint

Classification:

Long above knee: 55–75% of normal femur

Medium above knee: 35–55% of normal femur

Short above knee: Groin to 35% of normal femur

Functional hip disarticulation: Proximal to groin

Knee Disarticulation

Preserves full distal weight-bearing, often better than transfemoral amputation for prosthetic use.

Selection of Surgical Level

Upper Limb Amputations

Levels: Arm (transhumeral), forearm (transradial), disarticulations (shoulder, elbow, wrist), hand (transmetacarpal, transphalangeal).

Below Elbow (Transradial)

Ideal	8 inches
Minimum	2 inches
Maximum	3 inches from wrist

Classification by stump length (from medial epicondyle):

Very short: 0–35%

Short: 35–55%

Long: 55–90%

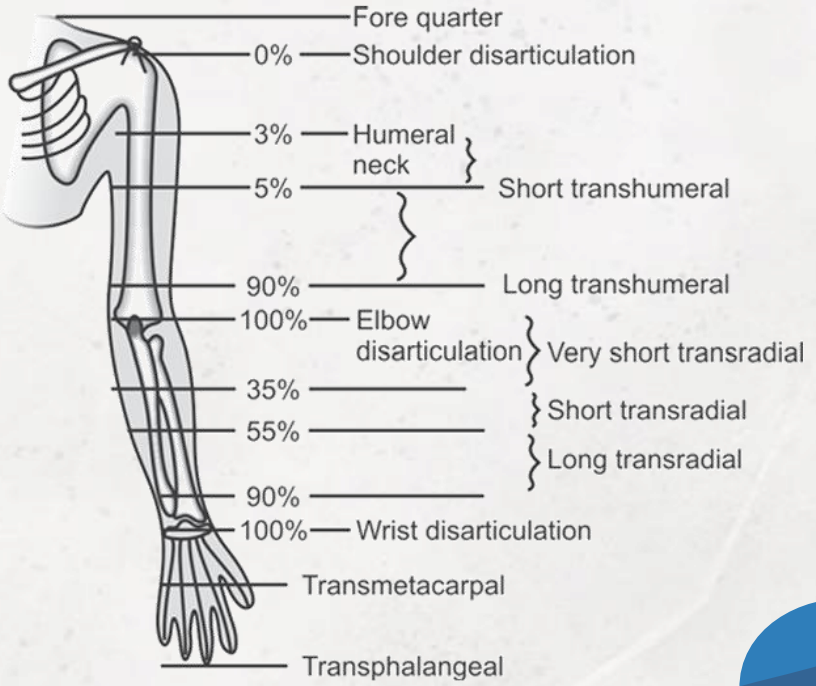
Selection of Surgical Level

Wrist DisarticulationLength:

90–100% from medial epicondyle

Above Elbow (Transhumeral)

Ideal	8 inches from acromion
Minimum	3 inches from acromion

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